

Feb. 10, 1942.

C. H. WOLF ET AL

2,272,784

AUTOMATIC SWITCH

Filed May 13, 1940

4 Sheets-Sheet 1

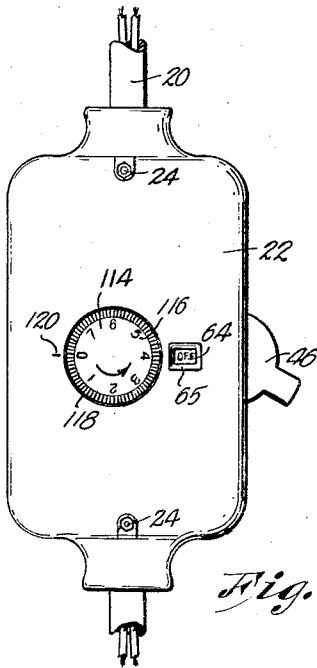


Fig. 1.

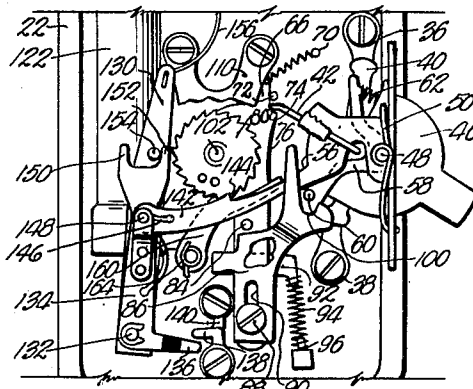


Fig. 7.

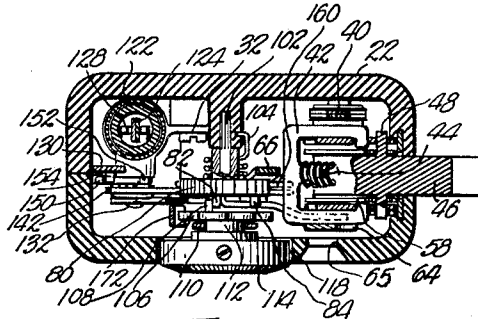


Fig. 8.

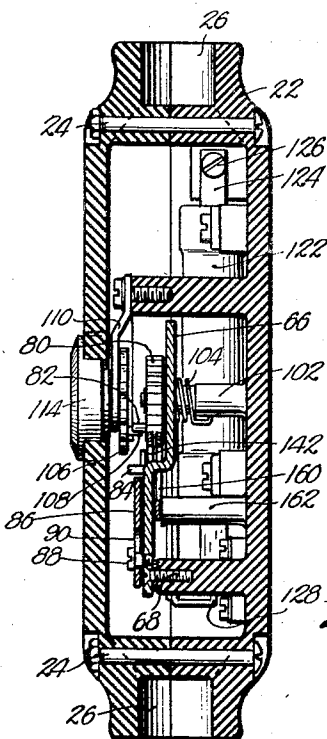


Fig. 6.

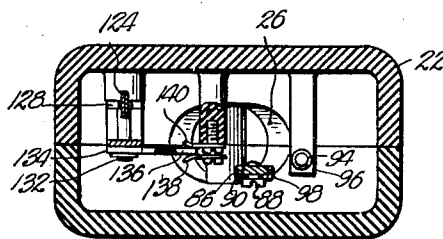


Fig. 9.

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4 Sheets-Sheet 2

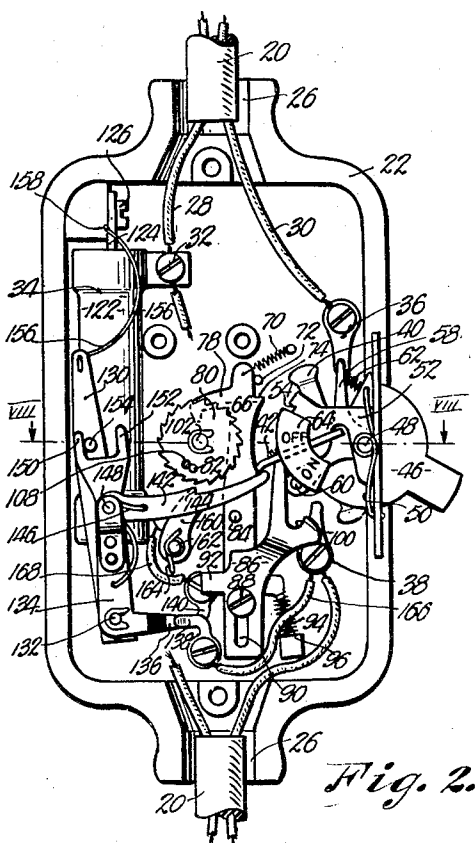


Fig. 2.

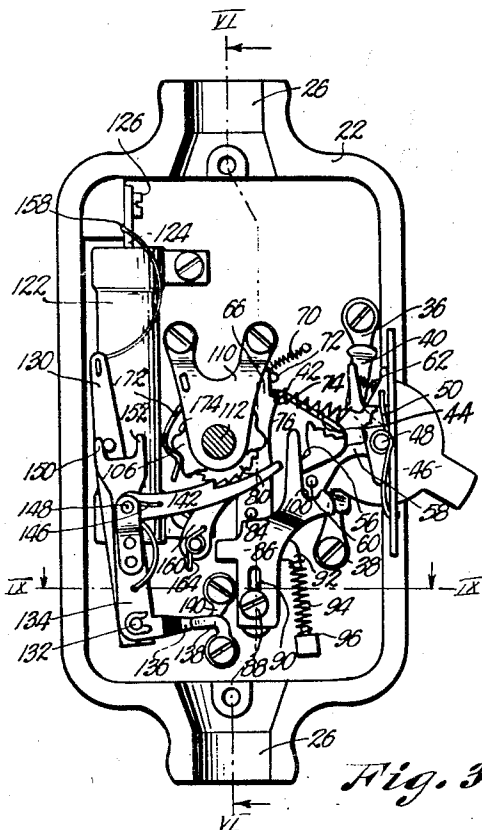


Fig. 3.

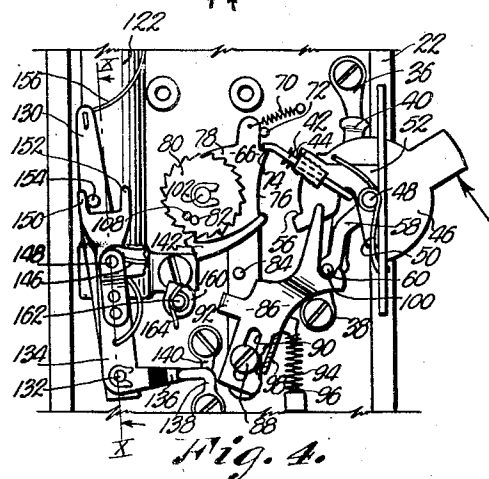


Fig. 4.

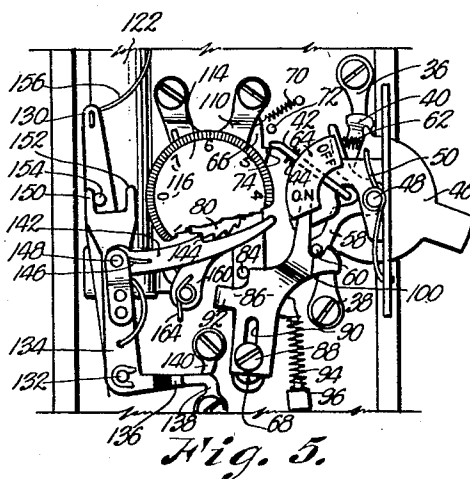


Fig. 5.

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2,272,784

AUTOMATIC SWITCH

Filed May 13, 1940

4 Sheets-Sheet 3

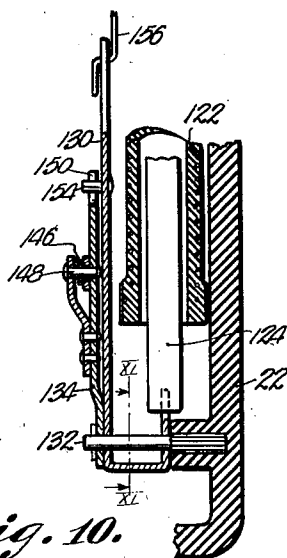


Fig. 10.

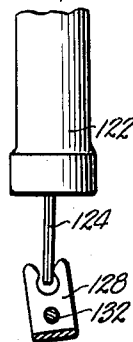


Fig. 11.

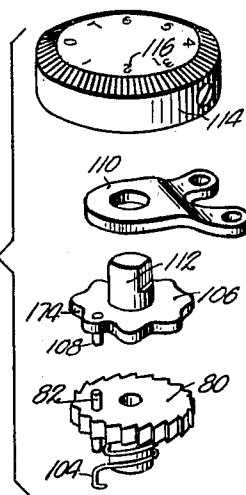


Fig. 12.

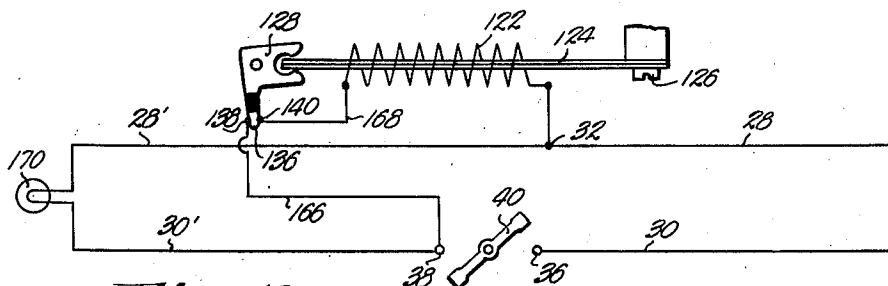


Fig. 13.

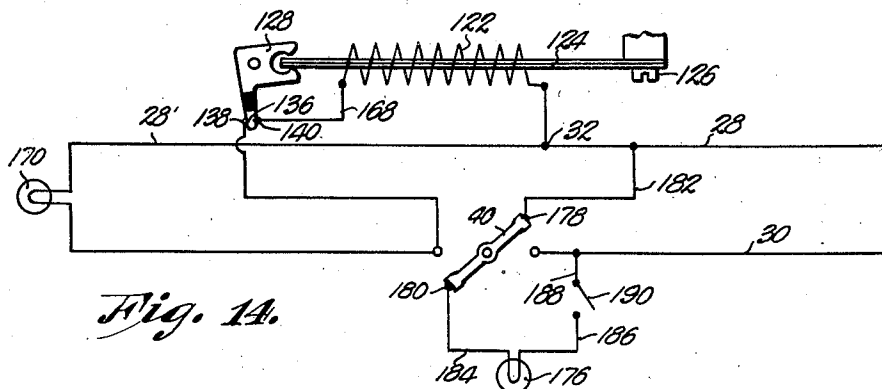


Fig. 14.

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AUTOMATIC SWITCH

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4 Sheets-Sheet 4

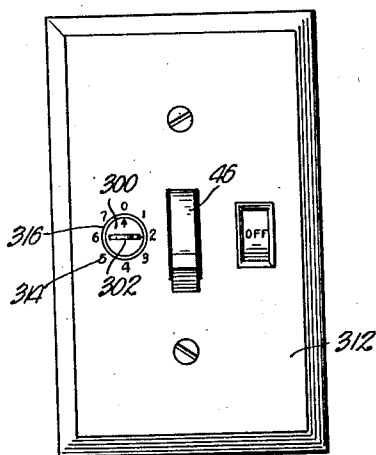


Fig. 15.

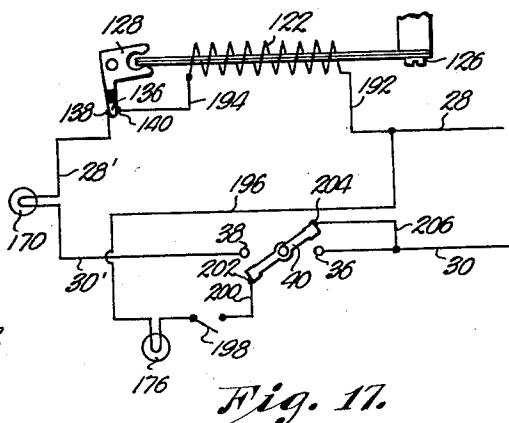


Fig. 17.

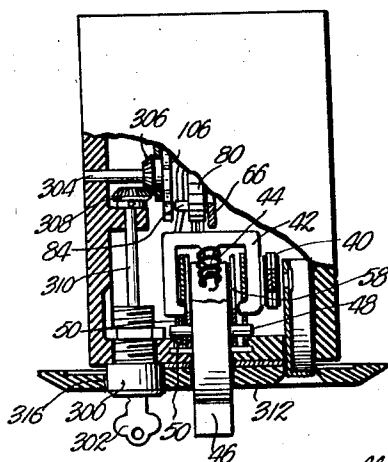


Fig. 16.

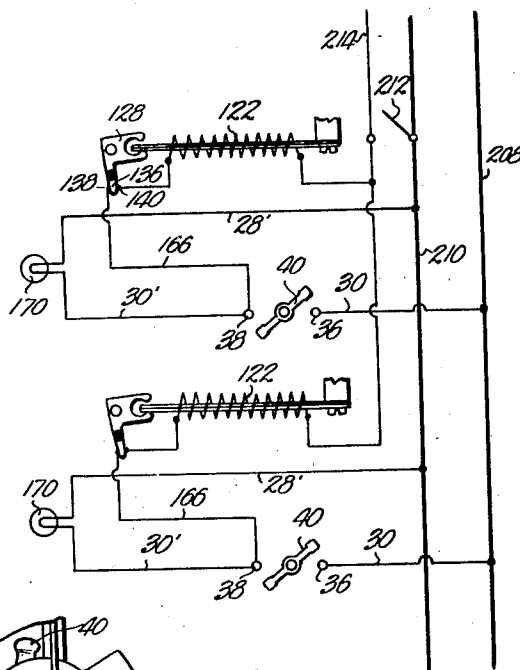


Fig. 18.

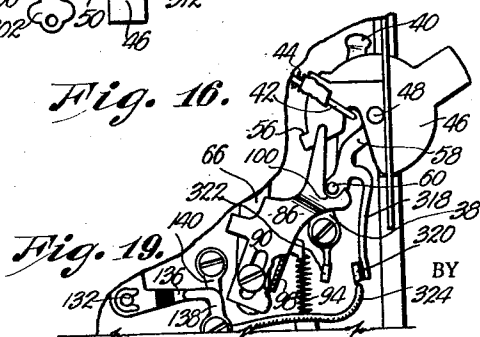


Fig. 19.

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UNITED STATES PATENT OFFICE

2,272,784

AUTOMATIC SWITCH

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Application May 13, 1940, Serial No. 334,712

19 Claims. (Cl. 200—122)

This invention relates to electric circuit breakers of the automatic type wherein manually settable means is incorporated for determining the period of time throughout which the circuit controlled by the switch remains closed.

One of the primary objects of this invention is to provide simple, inexpensive, compact and efficient circuit making and breaking structure, the character of which permits its use wherever electric appliances or lights are to be controlled, and especially where it is undesirable to burden the installation with heavy, complicated and expensive apparatus.

This invention has for one of its aims the provision of an automatic switch wherein is incorporated thermally responsive structure, the heating and cooling of a part of which serves to advance certain parts of the switch through a step-by-step movement and toward a position where advancement from one step to another will serve to operate the blade of the switch to the open-circuit position.

Another important object of this invention is the provision of an automatic electric switch, the parts of which are manually settable so that the switch blade may remain in the closed-circuit position for a predetermined length of time without the employment of expensive, complicated and intricate mechanism.

Another object of the invention is to provide an automatic switch of the aforementioned character having thermally responsive structure therein and having as a part thereof, at least one reciprocating element which is carried through its path of travel by the successive heating and cooling of a heating element, the supply of energy thereto being intermittently and periodically interrupted as the said reciprocating element is moved.

A still further aim of this invention is the provision of an electric switch, which has as a part thereof, a manually movable trigger operably connected to the switch blade in such manner as to cause the switch blade to assume the closed-circuit position upon movement of the trigger from one end of its path of travel to the other end thereof, and to thereafter cause the switch blade to assume an open-circuit position when the trigger is moved along the same path of travel as that traversed during the next preceding operation, which resulted in disposing the switch blade in the closed-circuit condition.

A still further object of this invention is to provide in an electric switch, a manually operable

trigger yieldably maintained at one end of a path of travel in a normal position and equipped with parts that will first move the switch blade to the closed-circuit position and immediately thereafter upon movement of the trigger, again will move the switch blade to the closed-circuit position.

A further and additional salient object of this invention is the provision of an automatic electric time switch, the parts of which may be housed in a compact case interposed in the conventional extension leading to a sign, light or electric appliance of any character, the current to which is to be interrupted after a predetermined length of time, which may be governed by a settable dial supported on the case.

Other objects of the invention include the manner of constructing, the means for embodying the concepts thereof, and therefore, additional aims will appear during the course of the following specification, referring to the accompanying drawings wherein:

Figure 1 is a side elevational view of an automatic switch made in accordance with the present invention.

Fig. 2 is an enlarged side elevational view of the automatic switch with one-half of the casing removed to reveal the operating parts.

Fig. 3 is a similar view but with the switch blade in the closed-circuit position.

Fig. 4 is a fragmentary side elevational view of a portion of the switch with the parts thereof in an intermediate position.

Fig. 5 is a similar view showing the parts of the switch in the place assumed thereby the instant before the switch blade returns to the open-circuit position.

Fig. 6 is a longitudinal irregular sectional view through an automatic switch, taken on line VI—VI of Fig. 3.

Fig. 7 is a fragmentary side elevational view of the switch parts showing the shunt circuit switch in the open position.

Fig. 8 is a transverse cross sectional view taken on line VIII—VIII of Fig. 2.

Fig. 9 is a similar cross sectional view taken on line IX—IX of Fig. 3.

Fig. 10 is an enlarged fragmentary sectional view taken on line X—X of Fig. 4.

Fig. 11 is a detailed sectional view taken on line XI—XI of Fig. 10.

Fig. 12 is a stretch-out perspective view of the manually movable dial knob and some of the parts associated therewith.

Fig. 13 is a wiring diagram employed in the switch.

Fig. 14 is another wiring diagram including a signal lamp.

Fig. 15 is a face view of an automatic switch made to embody a modified form of the invention.

Fig. 16 is a fragmentary plan view of the switch shown in Fig. 15.

Fig. 17 is a wiring diagram illustrating the manner of connecting the electrical resistor of the switch in series.

Fig. 18 is another wiring diagram indicating the manner in which an automatic switch embodying the invention, may be used in buildings; and

Fig. 19 is a fragmentary view of a portion of the switch illustrating the manner in which it may be constructed so that the switch blade is in the closed-circuit position with the circuit supplying energy to the resistor, open.

Because of the large number of advantages arising from a compact, automatic switch that may be placed in an extension cord 20 of conventional type, the same is confined in a case 22 formed of two mating sections held together by tie-bolts 24. The ends of case 22 are provided with bores 25 through which extension 20 may pass to permit the conductors 28 and 30 thereof to be attached to connection 32 of resistor 34 and switch point 36 respectively.

When interposing the switch in an ordinary extension cord 20, conductors 28 and 30 are severed and while two of the ends so produced are attached to connection 32 and switch point 36 as above mentioned, the other two ends are secured to connection 32 and switch point 38. Switch points 36 and 38 are interconnected by switch blade 40 when the latter is in the closed-circuit position.

A yoke 42 carries blade 40 so that the latter is moved with a snap action. Such action is obtained through the medium of the conventional past-center spring 44, one end of which bears against the bight of U-shaped yoke 42, while the other end thereof rests against the inner face of trigger 46. The trigger is pivotally mounted on pin 48 and a return spring 50 yieldably maintains the trigger in the normal position, shown in Figs. 2 and 3.

A stationary stop plate 52, rigid with case 22, has shoulders 54 and 56 thereon to limit the movement of yoke 42.

An auxiliary yoke 58 is mounted upon pin 48 intermediate its ends. One end of auxiliary yoke 58 carries a laterally extending stub 60, while the other end of auxiliary yoke 58 is yieldably held in spaced relation to the inner face of trigger 46 by spring 62.

A flag 64 integral with yoke 42 bears the usual indicia, i. e. "Off" and "On," which appears before window 65 to reveal to the user the position of switch blade 40.

An arm 66 pivotally mounted near one end as at 68 to case 22, extends longitudinally to a point adjacent to yoke 42 where spring 70 yieldably maintains the free end thereof against stop 72. A shoulder 74 and a cam face 76 cooperates with yoke 42 so that as the yoke is raised to the position shown in Fig. 3, the bight thereof will snap above shoulder 74 to be retained thereby.

A laterally projecting finger 78 lies directly behind ratchet 80 through which is passed a transverse pintle 82. The inner end of pintle 82 moves against a portion of finger 78 to release

yoke 42 in a manner more fully hereinafter set down.

A stop 84 on arm 66 intermediate the ends thereof cooperates with specially formed release member 86. This release member is shiftably mounted upon arm 66 through the medium of screw 88 that passes through slot 90. An extension 92 integral with release member 86 embraces arm 66 and passes therearound to a point where it is engaged by compression spring 94, one end of which is rigid with case 22 as at 96. A downturned portion 98 of release member 86 bears against one longitudinal edge of arm 66 to limit the swinging movement of member 86 about the axis of screw 88.

Release member 86 is laterally offset, as shown in Figs. 2 and 3, for example, so that a notch 100 thereof lies adjacent to stub 60. The upper free end of release member 86 underlies yoke 42 and limits the downward movement of this yoke when the same is in the position shown in Fig. 2, for example.

Ratchet 80 is provided with ratchet teeth in the annular periphery thereof and is mounted for rotation upon post 102 anchored to case 22. A spring 104 has one end fastened to ratchet 80, while the other end is secured to the post for the purpose of yieldably maintaining ratchet 80 in a set position.

Pintle 82 extends laterally to each side of ratchet 80 and is in the path of travel of setting disc 106 which has laterally extending pin 108. This setting disc is rotatably mounted in bracket 110 carried by a portion of case 22, as shown in Fig. 6, and shaft 112 on setting disc carries a knob 114 having indicia 116 on the outer face thereof. This knob 114 is mounted in an opening 118 provided in the side wall of case 22 and projects above the outer plane of case 22 so that the operator may easily manipulate the parts associated therewith, for the purpose of setting any one of the numerals forming indicia 116 opposite to marker 120 when the switch is set to allow the switch blade 40 to remain in the closed-circuit position a predetermined length of time.

The thermally responsive structure includes resistor 122 which circumscribes the bi-metallic strip 124, one end of which is anchored as at 126, while the free end thereof enters bifurcated head 128 formed on the lower end of rocker element 130. Rocker element 130 is pivotally mounted on shaft 132 as is bell-crank lever 134. One arm of lever 134 carries a head 136 of conducting material which serves to join switch points 138 and 140 when the thermally responsive structure is in the positions shown in Figs. 2 to 5.

The other arm of bell-crank lever 134 carries dog 142, the tooth 144 thereof being engageable with the teeth of ratchet 80. Dog 142 has a part projecting longitudinally beyond tooth 144 for engagement beneath yoke 42 and spring 146 yieldably urges dog 142 toward ratchet 80. A pin 148 pivotally attaches one end of dog 142 to bell-crank lever 134. The extreme upper end of one leg of bell-crank lever 134 is provided with spaced apart ears 150 and 152 respectively, between which rides pin 154 on rocker element 130. A spring 156 anchored to case 22 as at 158 and attached to the free end of rocker element 130, assists strip 124 in moving element 130.

Pawl 160 pivotally mounted upon case 22 as at 162 is yieldably maintained against ratchet 80 by spring 164. This pawl has an extension which lies behind the extended portion of dog 142 and

the free ends of dog 142 and pawl 160 are engageable by yoke 42 when the latter is at one end of its path of travel.

A conductor wire 166 joins switch point 38 and switch point 138, and another wire 168 joins switch point 140 and resistor 122.

The circuit employed in the switch just described, is shown in Fig. 13. It is assumed that the switch is controlling the flow of current to lamp 170. If the switch blade 40 is closed, as illustrated in Fig. 3, current will pass to lamp 170 through wires 28 and 28' and thence back to the source through wires 30 and 30' and switch blade 40. Resistor 122 is in shunt and current will pass through resistor 122 by way of connection 32, wire 168, closed contacts 140, 136, 138 and wire 166.

Assuming that the switch parts are in the normal inoperative position and the user desires to set the parts so that the circuit will be broken after four hours' time. Knob 114 is turned in the direction of the arrow (Fig. 1) which in turn will rotate shaft 112 about its axis so as to cause pin 108 to set disc 106 to bear against pin 82 of ratchet 80 as shaft 112 is rotated. Spring 172 will snap into the successive notches 174 of setting disc 106 so that the knob and its associated parts will have a tendency to dwell whenever one of the numerals on knob 114 arrives opposite to marker 120.

When the numeral four is disposed opposite to marker 120, the inner end of pin 82 in ratchet 80 will be spaced from the intumed portion of finger 78 a distance which will require the thermally responsive structure four hours to move pin 82 against finger 78. Thereafter the circuit is closed by an upward movement on trigger 46 which snaps yoke 42 from the position illustrated in Fig. 2 to the position shown in Fig. 3. The window 64 will reveal that the switch is "on" and yoke 42 will be resting upon shoulder 74 of arm 66. Switch blade 40 will bridge switch points 36 and 38 and current will flow through extension 20 and likewise through the shunt circuit wherein is disposed resistor 122.

If the switch is left in the condition shown in Fig. 3, the thermally responsive structure will proceed to move ratchet 80 in a step-by-step fashion against the force of spring 104. As the temperature of resistor 122 is raised strip 124 will bend to move bell-crank lever 134 and rocker element 130 about the axis of shaft 132. Spring 156 will assist the quick movement of the free end of rocker element 130 from the position shown in Fig. 2 to that position shown in Fig. 7.

When the thermally responsive parts have moved through one step as a result of a temperature rise, connector 136 will open switch points 138 and 140 and the resistor together with strip 124 will cool. When strip 124 has cooled and returned to its normal straight position, rocker element 130 will again assume the position it had in the beginning to cause switch points 138 and 140 to be closed. Heating again takes place and the operation just described is repeated.

As strip 124 cools to move dog 142 back to the point of beginning shown in Fig. 3, pawl 160 will hold ratchet wheel 80 against returning to its normal position under the influence of spring 104. Thus, the step-by-step movement, which is imparted to ratchet 80, will gradually move pin 82 against finger 78. When such relation is established, arm 66 will be moved to the left (Fig. 3) and yoke 42 will move down under the influence of compression spring 44 against the

outer free extended ends of dog 142 and pawl 160. Spring 44 has the axis thereof at an angle to the axis of yoke 42 for the purpose of creating a conventional "past center" action. These two elements will be separated from operative engagement with ratchet 80 and yoke 42 will again rest on the upper end of release member 86. When yoke 42 does move because of its being released by arm 66, switch blade 40 will be snapped to the open-circuit position.

Assuming that the switch has been set as above set down and it is desired to manually open the circuit by a second manipulation of trigger 46, the parts are in the relation illustrated in Fig. 3. Another upward movement on trigger 46 against the force of return spring 50 will cause auxiliary yoke 58 to move release member 86 to the position shown in Fig. 4, because stub 60 will engage notch 100 as trigger 46 forces auxiliary yoke 58 in a counter-clockwise direction about the axis of pin 48. Such interengagement of parts 60 and 100 will allow spring 94 to force release member 86 upwardly after it has been carried away from below stop 84. With upward pressure exerted on trigger 46, the parts will be as shown in Fig. 4. As soon as the upward pressure on trigger 46 is released, the side of release member 86 will move against stop 84, as shown in Fig. 5. Such action will carry arm 66 to the left (Figs. 3 to 5), against the action of spring 70 and yoke 42 will be allowed to return to the position shown in Fig. 2. When this movement takes place, yoke 42 will strike the upper end of release member 86, spring 94 will be compressed, and release member 86 will assume the normal position illustrated in Fig. 2.

From the foregoing it will be apparent that with the thermally responsive structure, set for the maximum time (approximately eight hours, as indicated in the drawings), the switch may be employed as means for manually making and breaking the circuit throughout the day and yet at any time, be quickly and easily converted into a time switch which will break the circuit, as predetermined by the user.

The wiring diagram of Fig. 14 is precisely the same as that of Fig. 13, except a signal lamp 176 is provided to indicate that the switch is in the "off" position. When switch blade 40 is "off" it bridges points 178 and 180 so that current is supplied from wire 28 through wire 182, wire 184, wire 186, wire 188 and wire 30 to signal lamp 176. A switch 190 is employed to selectively render the signal circuit operative.

The circuit in Fig. 17 illustrates the manner in which resistor 122 may be connected in series and not in shunt. The signal lamp 176 is employed to indicate that the switch is "off" and lamp 170 is the electrical device to which current is being supplied. When switch blade 40 is bridging points 38 and 36, the series circuit may be traced as follows: Wire 28, wire 192, resistor 122, wire 194, switch points 140, 136 and 138, wire 28', wire 30', switch points 38 and 36, which are closed by blade 40 and thence through wire 30. Obviously, the circuit for signal lamp 176 is as follows: Wire 28, wire 195, lamp 176, switch 198, wire 200, switch points 200 and 204, and wire 206.

An example of the manner in which this time switch may be employed is diagrammatically shown in Fig. 18. The switch blades 40 located in the switches in several rooms of a hotel, for example, control the flow of current from main

wire 208 back to main wire 210. Lamps 170 are controlled without the influence of the thermally responsive structure which would automatically open the circuit after a predetermined period of time.

In practice, for example, the thermally responsive structure is set for one hour and when the main switch 212 is closed by the proprietor, all of the lights will be controlled by the thermally responsive structure associated with each lamp 170. It is merely necessary to run an additional line 214 to the rooms where the switches are located so that the resistors 122 may form a part of the circuit control lamps 170.

The switch illustrated in Figs. 15 and 16 embodies a modified form of the invention. The parts throughout are precisely the same with the exception of the manually operable means employed to set the thermally responsive structure.

In this instance, a lock 300 with a key 302 is used to turn shaft 304, which serves to move the setting disc 106. This setting disc is rigid with shaft 304, as is bevelled gear 306 and a gear 308 on shaft 310 transmits the necessary rotary movement to setting disc 106 to accomplish the end hereinabove described.

The switch in Figs. 15 and 16 is housed in an ordinary switch box having a face plate 312 upon which indicia 314 is arranged. An opening 316 receives lock 300 and the use of key 302 prevents unauthorized persons from setting the switch or changing the period of time the circuit remains closed.

The manner of altering the structure of the switch so that no current flows to resistor 122 when switch blade 40 is in the closed-circuit position, is shown in Fig. 19. In this modification return spring 50 is not employed and trigger 46 will remain at either end of its path of travel under the influence of spring 44. Auxiliary yoke 58 has a branch 318 thereon which carries contact point 320 that cooperates with contact point 322 on switch point 38. A flexible conductor 324 joins switch point 320 and point 138.

After the switch parts are moved to the position shown in Fig. 19, yoke 42 will be held in the closed-circuit position by shoulder 74 on arm 66. Thereafter, if the thermally responsive structure is to be rendered operative, trigger 46 is manually moved down or back to its normal position or the point of beginning. Such action will leave yoke 42 in the position shown where switch blade 40 remains in the closed-circuit position. Points 320 and 322 will be moved together to complete the circuit to resistor 122.

An automatic switch made in accordance with the concepts of this invention is susceptible to a large number of uses and while some indication of the commercial embodiment has been made evident during the course of the foregoing specification, it is understood that forms other than those illustrated and described may be made without departing from the spirit of the appended claims.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. In an electric switch of the character described, a switch blade movable to the closed and open-circuit positions; a trigger movable by manual manipulation along a path of travel to and from a normal position; means operable by two successive movements of the trigger from the normal position to cause the switch blade to assume the closed-circuit and the open-circuit posi-

tions respectively; and means for yieldably maintaining the trigger in the normal position.

2. In an electric switch of the character described, a switch blade movable to the closed and open-circuit positions; a trigger movable by manual manipulation along a path of travel to and from a normal position; means operable by two successive movements of the trigger from the normal position to cause the switch blade to change its position with respect to the closed and open-circuit positions with a snap action; and means for yieldably maintaining the trigger in the normal position.

3. In an electric switch of the character described, a switch blade movable to the closed and open-circuit positions; a yoke supporting the switch blade; a trigger movable along a path of travel to and from a normal position; means for yieldably maintaining the trigger in the normal position; a spring between the trigger and said yoke for moving the yoke and said switch blade with a snap action; a catch to hold said switch blade in the closed-circuit position; and parts operable by movement of the trigger from the normal position to release the switch blade.

4. In an electric switch of the character described, a switch blade movable to the closed and open-circuit positions; a yoke supporting the switch blade; a trigger movable along a path of travel to and from a normal position; means for yieldably maintaining the trigger in the normal position; a spring between the trigger and said yoke for moving the yoke and said switch blade to the closed-circuit position with a snap action upon movement of the trigger from the normal position; a catch to hold said switch blade in said closed-circuit position as the trigger is returned to the normal position by means for maintaining the same in that position; and parts operable by the next successive movement of the trigger from the normal position to release the switch blade.

5. In an electric switch of the character described, a switch blade movable to the closed and open-circuit positions; a yoke supporting the switch blade; a trigger movable along a path of travel to and from a normal position; means for yieldably maintaining the trigger in the normal position; a spring between the trigger and said yoke for moving the yoke and said switch blade to the closed-circuit position with a snap action upon movement of the trigger from the normal position; a catch to hold said switch blade in said closed-circuit position as the trigger is returned to the normal position by the means for maintaining the same in that position; and parts operable by the next successive movement of the trigger from the normal position to release the switch blade, said parts being held in an inoperative position by the said yoke when the switch blade is in the open-circuit position.

6. In an electric switch of the character described, a switch blade movable to the closed and open-circuit positions; a yoke supporting the switch blade; a trigger movable along a path of travel to and from a normal position; means for yieldably maintaining the trigger in the normal position; a spring between the trigger and said yoke for moving the yoke and said switch blade to the closed-circuit position with a snap action upon movement of the trigger from the normal position; a catch to hold said switch blade in said closed-circuit position as the trigger is returned to the normal position by the

means for maintaining the same in that position; and parts operable by the next successive movement of the trigger from the normal position to release the switch blade, said parts being shiftable to the operative position upon movement of the switch blade to the closed-circuit position.

7. In an electric switch of the character described, a switch blade movable to the closed and open-circuit positions; a yoke supporting the switch blade; a trigger movable along a path of travel to and from a normal position; means for yieldably maintaining the trigger in the normal position; a spring between the trigger and said yoke for moving the yoke and said switch blade to the closed-circuit position with a snap action upon movement of the trigger from the normal position; a catch to hold said switch blade in said closed-circuit position as the trigger is returned to the normal position by the means for maintaining the same in that position; an auxiliary yoke adjacent to the trigger for operation thereby; a release member shiftable by the auxiliary yoke for releasing the catch to cause the switch blade to move to the open-circuit position; and structure for holding the release member inoperative until the trigger is moved from the normal position after once being moved from said position to shift the switch blade to the closed-circuit position.

8. In an electric switch of the character described, a switch blade movable to the closed and open-circuit positions; a yoke supporting the switch blade; a trigger movable along a path of travel to and from a normal position; means for yieldably maintaining the trigger in the normal position; a spring between the trigger and said yoke for moving the yoke and said switch blade to the closed-circuit position with a snap action upon movement of the trigger from the normal position; a catch to hold said switch blade in said closed-circuit position as the trigger is returned to the normal position by the means for maintaining the same in that position; an auxiliary yoke adjacent to the trigger for operation thereby; a release member shiftable by the auxiliary yoke for releasing the catch to cause the switch blade to move to the open-circuit position; and structure for holding the release member inoperative until the trigger is moved from the normal position after once being moved from said position to shift the switch blade to the closed-circuit position, said release member being held in a position where it is inoperative by the auxiliary yoke by the first mentioned yoke when the switch blade is in the open-circuit position.

9. In an electric switch of the character described, a switch blade movable to closed and open-circuit positions with a snap action; a trigger; means operable by the trigger to cause the switch blade to assume the closed-circuit position; a catch to hold the switch blade in the closed-circuit position; a member movable step-by-step for releasing the catch to cause the switch blade to assume the open-circuit position; and thermally responsive structure for imparting step-by-step movement to the said member.

10. In an electric switch of the character described, a switch blade movable to closed and open-circuit positions with a snap action; a trigger; means operable by the trigger to cause the switch blade to assume the closed-circuit position; a catch to hold the switch blade in the

closed-circuit position; a member movable step-by-step for releasing the catch to cause the switch blade to assume the open-circuit position; and thermally responsive structure for imparting step-by-step movement to the said member, said member being formed to release the catch when being moved through a certain one of its steps.

11. In an electric switch of the character described, a switch blade movable to the closed and open-circuit positions with a snap action; a trigger; means operable by the trigger to cause the switch blade to assume the closed-circuit position; a catch to hold the switch blade in the closed-circuit position; a member movable step-by-step for releasing the catch to cause the switch blade to assume the open-circuit position; and thermally responsive structure for imparting step-by-step movement to the said member, said thermally responsive structure having means for controlling the flow of a heating medium thereto operable to supply said medium during every other step of the step-by-step movement.

12. In an electric switch of the character described, a switch blade movable to the closed and open-circuit positions with a snap action; a trigger; means operable by the trigger to cause the switch blade to assume the closed-circuit position; a catch to hold the switch blade in the closed-circuit position; a member movable step-by-step for releasing the catch to cause the switch blade to assume the open-circuit position; and thermally responsive rocking element operably engaging the last mentioned member during movement in but one direction.

13. In an electric switch of the character described, a switch blade movable to the closed and open-circuit positions with a snap action; a trigger; means operable by the trigger to cause the switch blade to assume the closed-circuit position; a catch to hold the switch blade in the closed-circuit position; a member movable through a successive number of stations for releasing the catch when one of the stations is reached; thermally responsive structure for imparting step-by-step movement to the member to move the same through the number of stations; and means for setting the member where any one of a predetermined number of stations must be passed before the catch is released.

14. In an electric switch of the character described, a switch blade movable to the closed and open-circuit positions with a snap action; a trigger; means operable by the trigger to cause the switch blade to assume the closed-circuit position; a catch to hold the switch blade in the closed-circuit position; a movable member for releasing the catch to cause the switch blade to assume the open-circuit position when the member reaches a certain position; a reciprocating element for moving the member as the element passes along but one of its paths of travel; and thermally responsive structure for carrying the reciprocating element along its path of travel in said one direction.

15. In an electric switch of the character described, a switch blade movable to the closed and open-circuit position with a snap action; a trigger; means operable by the trigger to cause the switch blade to assume the closed-circuit position; a catch to hold the switch blade in the closed-circuit position; a movable member for releasing the catch to cause the switch blade to assume the open-circuit position when the mem-

ber reaches a certain position; a reciprocating element for moving the member as the element passes along but one of its paths of travel; and thermally responsive structure for carrying the reciprocating element along its path of travel in said one direction, said thermally responsive structure having an electrical heating element and a switch for controlling the supply of current to said element.

16. In an electric switch of the character described, a switch blade movable to the closed and open-circuit positions with a snap action; a trigger; means operable by the trigger to cause the switch blade to assume the closed-circuit position; a catch to hold the switch blade in the closed-circuit position; a movable member for releasing the catch to cause the switch blade to assume the open-circuit position when the member reaches a certain position; a reciprocating element for moving the member as the element passes along but one of its paths of travel; and thermally responsive structure for carrying the reciprocating element along its path of travel in said one direction, said thermally responsive structure having an electrical heating element and a switch for controlling the supply of current to said element, said switch having connection with the said reciprocating element and adapted to close the circuit supplying current to the heating element as the reciprocating element is carried along its path of travel in said one direction.

17. In an electric switch of the character described, a switch blade movable to the closed and open-circuit positions with a snap action; a trigger; means operable by the trigger to cause the switch blade to assume the closed-circuit position; a catch to hold the switch blade in the closed-circuit position; a movable member for releasing the catch to cause the switch blade to assume the open-circuit position when the member reaches a certain position; a reciprocating element for moving the member as the element passes along but one of its paths of travel; and thermally responsive structure for carrying the reciprocating element along its path of travel in said one direction, said thermally responsive structure having an electrical heating element and a switch for controlling the supply of current to said element, said switch having connection with

the said reciprocating element and adapted to close the circuit supplying current to the heating element as the reciprocating element is carried along its path of travel in said one direction, said switch being opened when the reciprocating element reaches one end of its path of travel in said one direction to allow the thermally responsive structure to be returned to the other end of its path of travel through the cooling of the thermally responsive structure.

18. In an electric switch of the character described, a switch blade movable to the closed and open-circuit positions with a snap action; a trigger; means operable by the trigger to cause the switch blade to assume the closed-circuit position; a catch to hold the switch blade in the closed-circuit position; a member movable step-by-step for releasing the catch to cause the switch blade to assume the open-circuit position; thermally responsive structure, including a bendable strip, and electrical means for supplying heat thereto, for imparting step-by-step movement to the said member; and a switch for controlling the flow of current to said electrical heating means, said switch being adapted to close during every other step of said movement and to open during alternate intervening steps whereby heating and cooling of the thermally responsive structure occurs to move the releasing member.

19. In an electric switch of the character described, a switch blade movable to the closed and open-circuit positions with a snap action; a trigger; means operable by the trigger to cause the switch blade to assume the closed-circuit position; a catch to hold the switch blade in the closed-circuit position; a ratchet wheel having a pin thereon engagable with the catch to release the same when the pin is in a certain position; a dog adapted to move the ratchet wheel in one direction about its axis of rotation; thermally responsive structure for carrying the dog through a path of travel to so move the ratchet; and means for supplying a heating medium to the said structure as the dog is advanced to move the ratchet, the said thermally responsive structure being adapted to return the dog to the point of beginning by its action due to cooling.

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